Beni-Suef Vet. Med. J. Vol. XIV. No. (1) July, 2004: (81 – 90).

OCULAR ULTRASONOGRAPHY OF CATARACT IN DOGS

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ABSTRACT

In this study, three cases of dogs of different ages suffering from unilateral opacities were admitted to clinic of faculty of veterinary medicine, Beni-Suef,. Cairo university. Thorough clinical examination of the dogs, special attention to examination of eyes was carried out. Ultrasonographic examination with 7.5 MHz transducer was applied directly on cornea of both eyes declared the occurrence of cataract in one eye. The opposite eye of each case was healthy and used as a control except in one .case only where the affected was suffering from blindness in addition to cataract. The ultrasonographic characterizations of normal eyes (the cornea, the anterior chamber of the eye, ciliary body, lens, vitreous chamber and the retina) were recorded. Accordingly, the diseased eye of each case was ultrasonographically examined. The characterization of image of cataract in each case was recorded and compared with echo pattern of normal lens. This study showed the utility of B-mode ultrasonography in imaging of normal dogs' eyes. Furthermore, declared the feasibility of B-mode ultrasound in examination of eye opacities and characterization of image of each cases.

INTRODUCTION

Ultrasonography is gaining popularity and usefulness in many clinical disciplines including gastroenterology, orthopedics, nephrology, theriogenology, cardiology and ophthalmology. Ultrasonography is non-invasive, safe, quick and painless examination (**Dziezyc and Hager, 1988**).

Ultrasonography has been used in ophthalmology in humans since the 1950s, but is a relatively new diagnostic tool in veterinary ophthalmology. The eye is an ideal organ to be examined ultrasonically because it is easily accessible and several reflecting surfaces or interfaces (**Morgan, 1989**).

Although, the range of pathological reactions exhibited by lens is small, it is ideal for ultrasonic examination because the lens is avascular, confined within a capsule and suspended in aqueous media (**Davidson and Nelms, 1999**).

Slatter (1990) declared that most lens diseases fall within the following groups; release of lens material within the eye, changes in position of the lens and loss of transparency (cataract). The author also defined cataract as a group of ocular disorders manifested by lens opacities of varying sizes and shapes and varying in etiology and rate of progression.

Numerous authors classified cataract in dogs according to many features; according to age of onset to congenital, juvenile, developmental (less than eight years of age) and senile (over eight years of age); by their location within the lens as determined by slit lamp biomicroscopy (**Davidson and Nelms, 1999**). Classifying cataracts by their degree of maturation provides the most useful information relative to the prognosis for vision. Very minute opacities are referred to as incipient cataracts, and generally obstruct less than 10% of the tapetal reflection when the lens is retro-illuminated. Cataracts are referred to as immature until they obstruct the entire tapetal reflection, after which they are considered mature cataracts. Cataracts are considered hypermature if lens material has become liquefied and are recognized by a rough or irregular anterior lens capsule with a deep anterior chamber or the presence of clinical signs of uveitis (aqueous flare and low intraocular pressure). If enough cortex liquefies the nucleus will settle to the bottom of lens capsule, the cataract is termed Morgagnian (**Spencer 1985; Slatter 1990 and Davidson and Nelms, 1999**).

Noxious influences affecting any of the following lens functions may result in opacity; lens nutrition, energy metabolism, and osmotic balance. This accounts for the large number of factors that may cause cataract e.g. radiation, microbial infectious, parasitic, senile and metabolic disorder (diabetes mellitus) in dog **(Slatter, 1990 and Davidson and Nelms, 1999)**.

The present study aimed to evaluate ultrasonography in examination of eye; by determination of sonogram of normal dogs' eyes and sonogram of cataract of diseased dogs.

MATERIAL AND METHODS

This study was carried out on three dogs suffering from unilateral opacity admitted to clinic of faculty of veterinary medicine, Beni-Suef Branch, Cairo University. General criteria of cases were presented for white appearance of the eyes for long time which progressed rapidly 2 weeks before examination. The white appearance was worse at night when the pupil was dilated. Changing in animal behaviors as timidity was observed. There was no previous clinical examination. The cases were as followings:

1-Case No. 1: about two-year-old male mixed breed dog presented with left eye opacity

2-Case No. 2: about five-year-old male mixed breed dog suffered from right eye opacity.

3-Case No. 3: about six-year-old female mongrel dog was presented with the right eye opacity.

The cases were subjected to thorough clinical examination with special attention to the eye examination including menace test and pen light reflex test according to (**Radostits *et al.*, 2000**) and (**Wilkie, 2001**).

Ultrasonographic examination:

Before ultrasonographic examination, examined animal was sedated by using **Valipam®** (*Diazepam from Amoun for pharmaceutical preparations*), then local anesthesia was instilled in each eye by using **Binox®** 0.4% (*binoxate HCL fro EPICO*). The animal was placed in sternal recumbence on an examination table. Sterile ultrasound coupling gel **K-Y lubricating jelly®** (from *Johnson & Johnson, New Bunswick, NJ*) was placed directly on cornea of eye (**Van der Woerdt *et al.*, 1993**).

A B-mode real-time electronic sector scanner with 7.5 MHz transducer was used (240 Parus vet. from Pie Medical, Netherlands). Images were recorded on a floppy disk. A series of horizontal and vertical views of both orbit were obtained by applying the transducer directly on cornea according to **Hager *et al.*, (1987)**. In horizontal position (Fig. 1), the long axis of transducer refers medially to nasal bone and laterally to temporal bone. In vertical position (Fig. 2) the long axis of the transducer refers to dorsal and ventral of the eye. The eye being examined should be scanned in oblique sections gradually between horizontal and vertical sections to complete eye examination. After examination gel was removed by careful irrigation of the eye with sterile eye wash or normal saline.

RESULTS

Clinical examination:

Clinical examination revealed unilateral opacities and no other clinical abnormalities could be detected. Meanwhile, results of the menace test and pen light reflex test of the affected eye were positive in cases No. 1 and 2 i. e. the animals still have a vision and negative in case No. 3 i. e. blindness of examined eye.

Ultrasonographic examination:

Sonograms are shown in (Figs. 3 – 6) for interpretations of sonogram it is important to apply the real direction of the animal on monitor. In horizontal section, the left side of the image represents the medial (nasal) side of examined animal. This could be applied practically by orientation of the mark of the transducer toward the nasal bone. In vertical section, the left side of the image represents the ventral direction as the mark of the transducer direct toward ventral side of the eye (Figs. 1 - 2).

DISCUSSION

In ultrasonography, the display of echoes is produced by the reflection of ultrasound waves at the interface of tissues with different acoustic impedances (**Van der Woerdt *et al.*, 1993**). Two-dimensional ocular ultrasonography is an excellent soft tissue imaging modality for evaluating the orbit and periorbital tissues. Its usefulness in examining cloudy or opaque eyes has already been documented in the dogs (**Miller and Cartee, 1985**).

The echo pattern of cornea of normal dog's eyes appeared as hyperechoic line with above hyperechoic spot represented the artifact (Figs. 3 A & B). in some instances, near filed artifact may intense producing a poor image of anterior chamber and lens. Overcoming this artifact built in transducer water bath or off set or at least small balloon could be applied on cornea (**Hager *et al.*, 1987**).

Anterior chamber appeared ultrasonically as anechoic area in between the cornea and anterior lens capsule. Posterior chamber of normal dog's eye could not be ultrasonically detected.

The lens appeared ultrasonically as two hyperechoic lines representing the anterior and posterior lens capsule and in between anechoic area (Figs. 3 A & B). Ciliary bodies appeared as hyperechoic area on both side of the eye at the level just under of the echo of anterior lens capsule and above the posterior one. Vitreous chamber appeared normally as anechoic area occupying most of the eye. The area of the eye just behind the level of ciliary bodies appeared normally as anechoic with the presence of hyperechoic spot representing the posterior lens capsule. In real-time examination, detection of vitreous abnormalities depends on the degree of time gain compensation. By increasing far field gain, subtle differences in echogenicity will be more pronounced, making vitreous abnormalities easier to be detected. If ultrasonographic examination of the eye is not performed at various gains setting, vitreous abnormalities may go unnoticed (**Van der Woerdt *et al.*, 1993**).

The normal retina of the eye appeared ultrasonographically at the caudal area of image in form as a continuous, smooth hyperechoic curve

(Figs. 3 A & B).came in accordance with echo patterns of normal dog's eye described by **Dziezyc** ***et al.*****, (1987)** and **Van der Woerdt** ***et al,*****. (1993)**.

Sonogram of case No. 1 (Fig. 4) showing well demarcated lens by hyperechoic line and narrowing of anterior chamber in comparing with sonogram of normal eye (Fig. 3 B). These abnormalities referred to cataract of the lens. Sonogram of case No. 2 (Fig. 5) had similar results where enlargement of the lens with hyperechoic opacity indicated to cataract. These results are similar to those mentioned by **Van der Woerdt** ***et al.*****, (1993)**.

The clinical examination of cases No. 1 and 2 revealed that the eyes being examined were not blind. Evaluation of sonogram finding in context of clinical examination emphasized that the type of cataract in cases No. 1 and 2 is immature as the opacity in these cases is clear but still incomplete and the fundus may be partially obscured (**Slatter, 1990**).

Evaluation of sonogram of case No. 3 (Fig. 6) revealed shrunk lens resulting in enlargement of anterior chamber. The clinical examination of the right eye revealed complete blindness. Abnormalities of sonogram of case No. 3 is typical for hypermature cataract which accompanied by complete blindness (**Van der Woerdt** ***et al.*****, 1993**). In hypermature cataract, a part of lens material liquefied with rough and irregular lens capsule (**Davidson and Nelms, 1999**) resulting in appearance of lens in sonogram as in (Fig. 6).

In conclusion, ultrasonography allowed identification of eye structure and can be used to identify cataract. So, it could be used as a part of clinical examination of the eye because it is an easy test to perform and is well tolerated. Moreover, interpretation of the image obtained is not difficult. In most animals, the opposite eye and orbit provide a normal control that can be compared to the abnormal eye.

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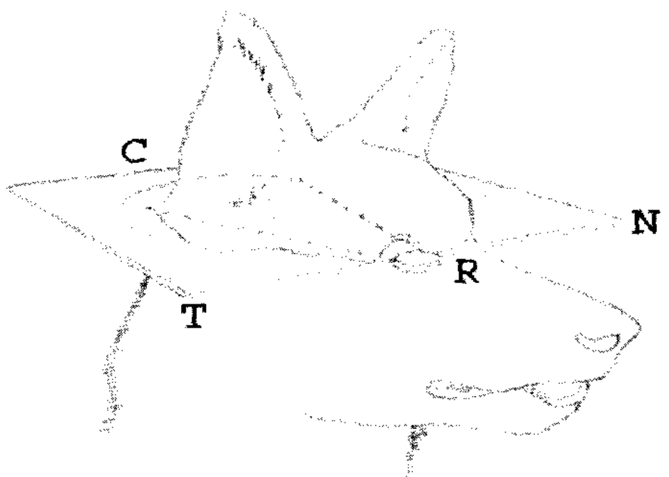

Fig. (1): Transducer position for two-dimensional ocular ultrasonography, horizontal view. N = nasal, T = temporal, R = rostral, C = caudal.

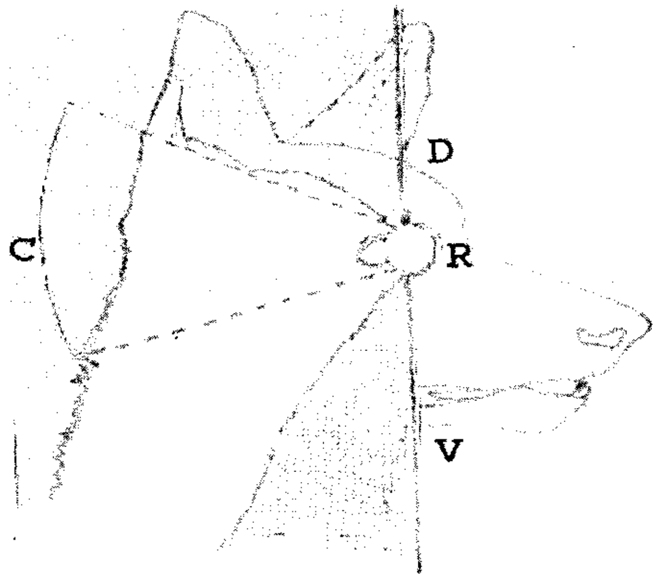

Fig. (2): Transducer position for two-dimensional ocular ultrasonography, vertical view. D = dorsal, V = ventral, R = rostral, C = caudal.

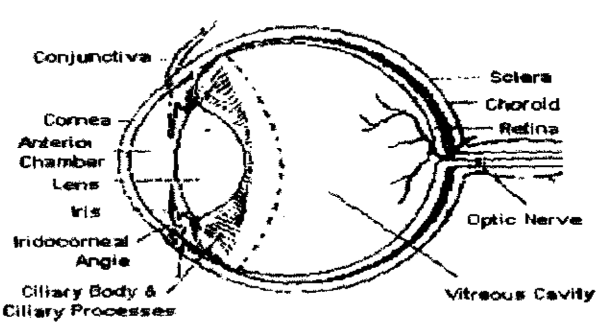

Fig. (3 - A): A diagram showing gross anatomy of eye of dog.

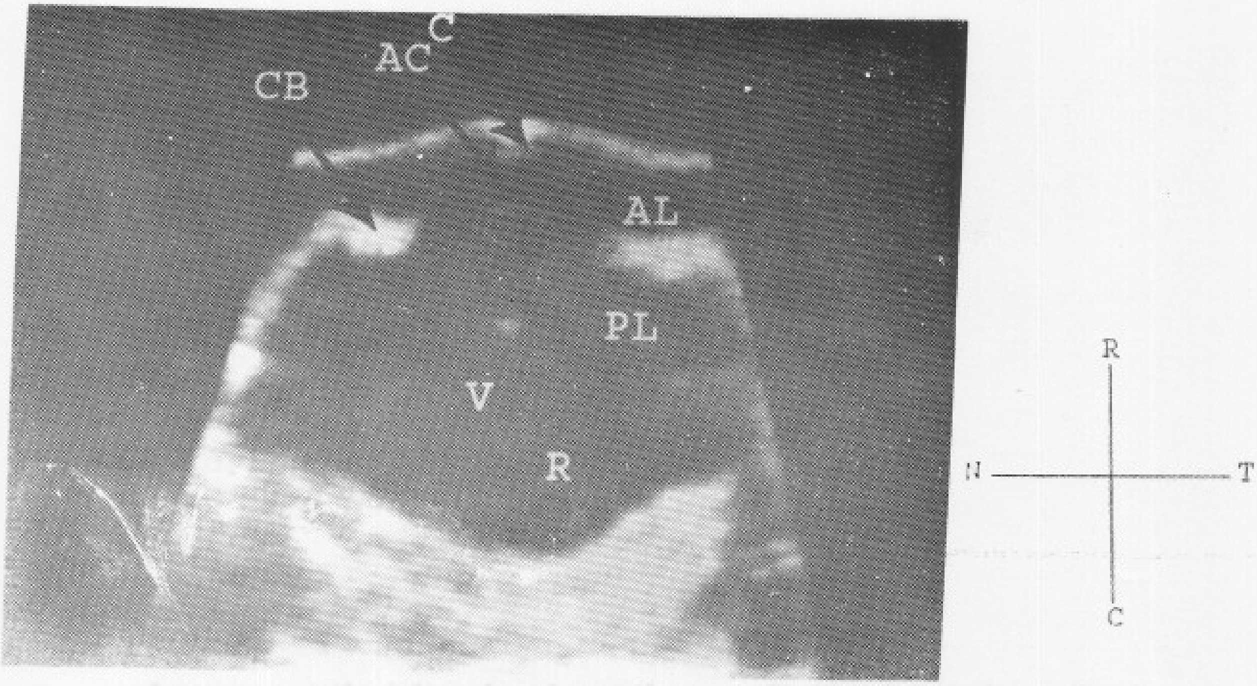

**Fig. (3 - B): Horizontal sonogram of normal eye of dog showing cornea (C), anterior chamber (AC), anterior lens capsule (AL), posterior lens capsule (PL), ciliary body (CB), vitreous chamber (V), and retina (R).
Directional terms: R = Rostral, T = Temporal, N = Nasal, C = Caudal.**

**Fig. (4): Horizontal sonogram of case No. 1 showing cornea (C), anterior chamber (AC) which is very narrow as the result of swelling of eye lens which appear as hyperechoic circle (white arrow), retina (R).
Directional terms: R = Rostral, T = Temporal, N = Nasal, C = Caudal.**

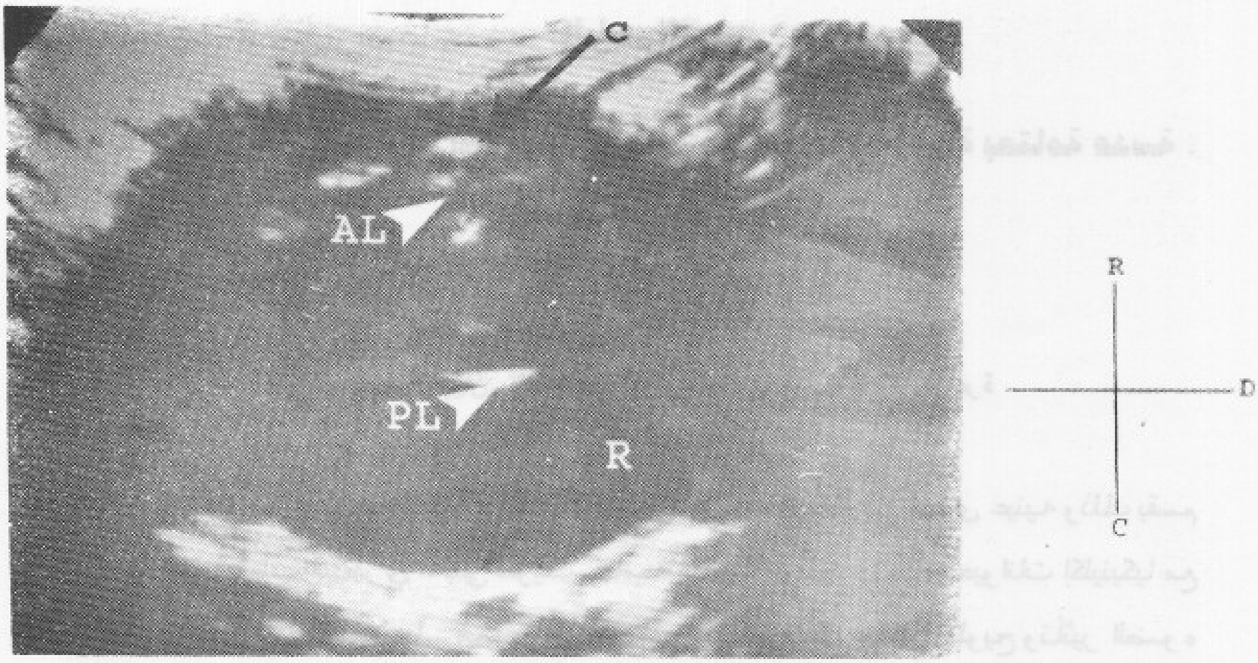

Fig. (5): Vertical section sonogram of case No. 2 showing cornea (C), retina (R), and the lens (white arrow) with hyperechoic area in-between the anterior and posterior lens capsule (upper and lower white arrows).
Directional terms: R = Rostral, V = Ventral, D = Dorsal, C = Caudal.

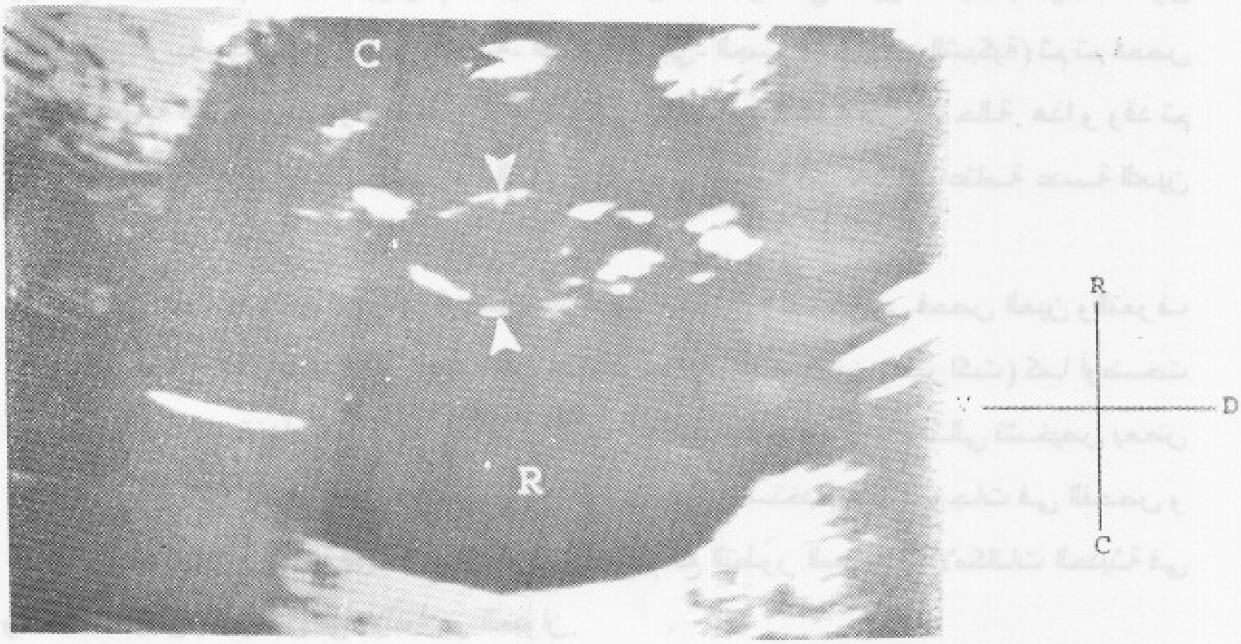

Fig. (6): Vertical sonogram of the case No. 3 showing cornea (C), retina (R), and lens (white arrows) which appears as interrupted hyperechoic areas represented rough irregular capsule (notice the enlarged anterior chamber between the lens and the cornea).
Directional terms: R = Rostral, T = Temporal, N = Nasal, C = Caudal.

الملخص العربي

استخدام الموجات فوق الصوتية في فحص عيون الكلاب المصابة بعتامة عدسة العين (الكتراكت)

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في هذه الدراسة تم فحص ثلاثة كلاب كلاً منها يعاني من العتامة في إحدى عينيه وذلك بقسم طب الحيوان بكلية الطب البيطري – بني سويف- جامعة القاهرة. تم فحص هذه الحيوانات إكلينيكيا مع إجراء فحص دقيق للعين مشتملاً على قياس ردود الأفعال المنعكسة مثل اختبار التلويح وتأثير الضوء على إنسان العين في العيون السليمة والمصابة لهذه الحيوانات. وقد وجد أن إحدى هذه الكلاب مصاب بعمى في العين التي بها العتامة ثم تم فحص العيون السليمة بجهاز الموجات فوق الصوتية ثنائي الأبعاد وباستخدام مجس (٧,٥ ميجاهرتز) يوضع على القرنية مباشرة بعد استخدام القطرة المخدرة ووضع الجيل المعقم داخل العين وتم تسجيل خصائص كل جزء في العين السليمة بالموجات فوق الصوتية (القرنية- الحجرة الأمامية- العدسة- الجسم الهدبي- الجسم الزجاجي- الشبكية) ثم تم فحص العين المصابة كلاً على حده وتم تسجيل التغيرات التي وجدت في العدسة في كل حالة. هذا و وقد تم التعرف بوضوح كامل على التغيرات التي تحدث في العدسة في حالات عتامة عدسة العين (الكتراكت).

وقد اثبت هذه الدراسة انه يمكن استخدام الموجات فوق الصوتية في فحص العين و التعرف على مدى التغير التي تحدث في العدسة في حالات عتامة عدسة الغين (الكتراكت) كما أوضحت الدراسة إمكانية استخدام هذه الموجات فوق الصوتية فى فحص العين و بالتالي تشخيص بعض أمراض العيون عملا على ما يجرى الآن من تزايد مستمر استخدام هذه الموجات فى الفحص و التشخيص فى نواحى متعددة فى الطب البيطري و تمشيا مع التطور السريع و الامكانات الحديثة فى وسائل تشخيص الأمراض فى الإنسان و الحيوان.